Abstract View

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On the Structure and Dynamics of Monthly Mean Sea Level Anomalies along the Pacific Coast of North and South America

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ABSTRACT

The behavior and relationship of anomalies of monthly mean sea level, coastal sea surface temperature and alongshore wind stress for the eastern Pacific Ocean during the period 1950–74 have been studied. Sea level and temperature records from Yakutat, Alaska (59°N) to Valparaiso, Chile (33°S) and computed alongshore wind stress at near coastal grid points from Yakutat to Matzatlan, Mexico (23°N) have been utilized. The positive and negative sea level anomalies, corresponding to El Niño-anti El Niño cycles, are well correlated throughout the tropics of both hemispheres and are detectable at the California stations. From Crescent City to Antofagasta, Chile the sea level anomalies were correlated with the Southern Oscillation Index above the 99% significance level. The maximum station separations for which sea level anomalies were correlated among themselves above the 99% significance level varied from 6000 km (Yakutat to San Diego) to more than 12 000 km (Prince Rupert to Matarani). A well-defined tagged correlation structure of the sea level anomalies exists which suggests a poleward propagation of events in the Northern Hemisphere and leads to a phase speed estimate of 180 ± 100 km day^{-1}. Cross-spectral results imply that the propagation occurs predominantly at subannual frequencies and lead to a lower range of phase speeds (60–100 km day^{-1}). These estimates are consistent with theory and observations concerning wave propagation processes but are too fast to be explained by large-scale advective processes. The correlations of sea level anomalies with anomalies of the local alongshore wind stress are greatest from Sitka to Crescent City; they decrease south of Crescent City, with a marginal value at San Francisco and no significant correlation at San Diego. Between Neah Bay and San Francisco, the relation between the alongshore sea level slope and the alongshore component of the wind stress is consistent with a mass balance between a geostrophic onshore-offshore velocity below the surface layer and an onshore-offshore Ekman transport.

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